"LAND UTILIZATION IN FORMOSA*

* Owing to limitations of space, the text of this article has been considerably condensed from the author's original manuscript, and several tables have been omitted. Also, the difficulties of time and distance have prevented the author from seeing galley proof. --Edit. Note.

Cheng-Siang Chen

Land utilization in Formosa is severely handicapped by the topography. Forest-covered mountains rising to impressive heights form a central range, which extends like a backbone the entire length of the island. Only 36 per cent of the land is utilized, and only 24 per cent of this is cultivated.

According to the comparatively reliable statistics of 1947, the total area of utilized land is 1,290,132 hectares, of which 66 per cent is cultivated (paddy fields, 41 per cent; dry fields, 25 per cent). Considerable changes have occurred during the last 20 years or so Table 1 (1). The percentage of paddy fields has increased, and that of dry fields

1. All tables are based on data contained in the Taiwan

Agricultural Yearbook, Dept. of Agriculture and Forestry, Taipei.

has decreased, as a result of the development of irrigation and drainage. The progress of economic forestation is reflected in an increase of the forested land; the growing popularity of cremation has reduced the burial ground. Land in railroads and highways has also increased, because of the expansion and development of communications."

8: Chen--438 [2] N-3 (no date) 1951 Formosans
116, 311

TABLE I—LAND CLASSIFICATION IN FORMOSA
(*In hectares*)

CLASSIFICATION	1920 AREA	1920 %	1930 AREA	1930 %	1940 AREA	1940 %	1947 AREA	1947 %
Paddy fields	354,885	34.7	392,176	31.8	527,192	41.5	524,253	40.6
Dry fields	353,581	34.5	388,083	31.5	316,030	24.9	318,985	24.7
Forested	121,408	11.9	268,424	21.8	273,776	21.6	260,748	20.2
Prairie	97,744	9.5	71,665	5.8	36,423	2.9	59,308	4.6
Building sites	34,521	3.4	36,674	3.0	41,496	3.3	43,325	3.4
Irrigation ditches	....	...	13,229	1.1	15,824	1.2	16,685	1.3
Irrigation ponds	13,838	1.4	13,003	1.0	12,073	0.9	12,167	0.9
Burial ground	15,575	1.5	12,819	1.0	11,624	0.9	11,371	0.9
Railroads and highways	....	...	2,710	0.2	9,349	0.7	10,688	0.8
Piscicultural ponds	24,710	2.4	21,558	1.7	11,820	0.9	10,431	0.8
Salt fields	1,385	0.1	2,054	0.2	4,878	0.4	7,101	0.6
Pasture	3,567	0.3	5,020	0.4	2,267	0.2	764	0.1
Temple sites	484	0.1	511	0.1	626	0.1	677	0.1
Miscellaneous	2,439	0.2	4,596	0.4	6,693	0.5	13,629	1.0
Total	1,024,137	100.0	1,232,522	100.0	1,270,077	100.0	1,290,132	100.0

8: Chen--439 N-3 (no date) 1951 Formosans
116, 133, 311

"The distribution of land use (exclusive of cultivated land) among the hsiens [EJ: i. e. the administrative districts of Formosa] is an index to their geographic characteristics. For example, 56 per cent of the irrigation ditches of the island are in Tainan, a percentage obviously related to the great Kianan irrigation system; and 70 per cent of the irrigation ponds are in Hsinchu, because the topography of the Taoyuan alluvial fan, in the northern part, makes it suitable for damming. Ninety-six per cent of the piscicultural ponds are in Tainan and Kaohsiung, because the waters off the southwest coast are shallow and there are many lagoons and narrow inlets that can be converted into piscicultural ponds; and 89 per cent of the salt fields are in Tainan, whose coastal plain, low, very dry, and with brilliant sunshine in winter, offers good natural conditions for saltmaking. And in Penghu hsien burial grounds occupy 10. 3 per cent of the utilized land, both because the Pescadores Islands are the earliest-developed and most densely populated area and because the meager land is unsuitable for cultivation (more than 60 per cent of the inhabitants are dependent on sea fisheries for sustenance).

8: Chen--439-441 N-3 (no date) 1951 Formosans--1-3
116, 311

"CULTIVATED LAND

Formosa's 35,961 square kilometers may be divided into level land (administrative regions) and hilly land (aboriginal regions). The total area of level land is about 19,800 square kilometers; its index of cultivation (2) is [440] 43 per cent. The total area of

> 2. The 'index of cultivation' is the percentage of cultivated land in the total land area. The total land area of Formosa, including Penghu and other islands, is 3,596,100 hectares; the total area of cultivated land (10-year average, 1936 to 1945) is 846,552 hectares. Hence the index of cultivation is 23.5 per cent, which is higher than that for South China, Japan, or Korea.

hilly land is about 16,100 square kilometers; its index of cultivation is only 2 per cent. Ninety-four per cent of the cultivated land lies in the coastal plains of the five western hsiens; Hwalien, Taitung, and Penghu together contain only 6 per cent (Table II). The extensive mountainous interior is covered with forests, in which there is little farmland.

The amount of cultivated land increased rapidly from 674,100 hectares in 1910 (Table III)

to 860,439 hectares in 1940. But after 1940 there was a gradual slowing down followed by another increase, and the index of cultivation seems now to be approaching saturation. Among the hsiens, the index for Penghu is highest, 58 per cent; that for Hwalien and Taitung is lowest, only 5-6 per cent (Table II).

The cultivated land may be roughly classified into paddy fields and dry fields. In 1910 paddy fields occupied about 49 per cent of the total cultivated land, dry fields 51 per cent. In 1948, as a result of the spread of irrigation and [441] the consequent change of dry fields into paddy fields, the corresponding percentages were 61 and 39 (Table III).

The price of paddy fields differs greatly from that of dry fields, because of the difference in productivity. From 1938 to 1942 the average price of paddy fields was 3615 yen per hectare; that of dry fields, only 1748 yen. The price of both paddy and dry fields was higher in the five western hsiens than in the two eastern hsiens: respectively 3639 yen and 1815 yen per hectare in the west; 2996 yen and only 917 yen in the east. According to the 'Survey on Farm Rent Economy' published in 1937 by the Formosa government, the average rent for paddy fields is about 48 per cent of the value of the products; that for dry fields is 33 per cent."

8: Chen--439-441 N-3 (no date) 1951 Formosans-3
116, 311

TABLE II—CULTIVATED LAND BY HSIENS, 1940 AND 1948

HSIEN	1940			1948		
	CULTIVATED LAND		INDEX OF CULTIVATION	CULTIVATED LAND		INDEX OF CULTIVATION
	Hectares	%	%	*Hectares*	%	%
Taipei	93,657	10.88	20.39	90,389	10.47	19.68
Hsinchu	148,410	17.25	32.47	150,574	17.45	32.95
Taichung	172,058	20.00	23.30	175,511	20.33	23.77
Tainan	267,779	31.12	49.34	261,032	30.25	48.15
Kaohsiung	127,342	14.80	22.25	131,976	15.29	23.06
Taitung	17,376	2.02	4.94	20,701	2.40	5.89
Hwalien	26,803	3.12	5.79	25,582	2.96	5.53
Penghu	7,014	0.83	55.29	7,371	0.85	58.04
Province	860,439	100.00	23.93	863,156	100.00	24.00

TABLE III—CULTIVATED LAND AND INDEX OF CULTIVATION

YEAR	CULTIVATED LAND	INCREASE INDEX	INDEX OF CULTIVATION	PADDY FIELDS		DRY FIELDS	
	Hectares		%	*Hectares*	%	*Hectares*	%
1900	347,408	100	9.7	194,656	56.0	152,752	44.0
1905	624,301[a]	180	17.4	304,908	48.8	319,393	51.2
1910	674,100	194	18.7	332,372	49.3	341,728	50.7
1915	700,080	202	19.5	343,087	49.0	356,993	51.0
1920	749,419	216	20.8	367,177	49.0	382,242	51.0
1925	775,468	223	21.6	373,629	48.2	401,839	51.8
1930	812,116	234	22.6	396,670	48.8	415,446	51.2
1935	831,003	239	23.1	478,689	57.6	352,314	42.4
1940	860,439	248	23.9	529,610	61.6	330,829	38.4
1945	816,016	235	22.7	504,709	61.9	331,307	38.1
1948	863,156	248	24.0	526,391	61.0	336,765	39.0

[a] The sudden increase from 1900 to 1905 resulted chiefly from the discovery of unregistered land by the official survey.

TABLE IV- FARM FAMILIES AND SIZE OF FARMS
(*In cha*[a])

DATE	TOTAL	0.5	0.5–1	1–2	2–3	3–5	5–7	7–10	10–20	20+
Oct. 1920	423,278	127,998	96,933	100,403	45,563	33,342	10,362	5,101	2,997	579
"	100	30.23	22.87	23.72	10.76	7.84	2.43	1.24	0.78	0.13
Apr. 1939	436,593	111,805	90,007	113,117	57,521	41,749	13,129	5,938	2,796	531
"	100	25.61	20.62	25.91	13.17	9.56	3.01	1.36	0.64	0.12

[a] 1 cha = 0.96992 hectare.

8: Chen--441 [2] N-3 (no date) 1951 Formosans
116, 162, 241, 311, 511

"SIZE OF FARMS

The agricultural population of Formosa is constantly increasing, though the percentage has fallen a little. But the area of cultivated land cannot be extended; consequently, the farms are generally very small, as in the provinces of China proper; moreover, the inheritance system breaks up the farms and further reduces the average size. From 1936 to 1945 the total area of cultivated land in Formosa averaged 846, 552 hectares, the number of farm families 448, 474; thus each farm family had only 1. 89 hectares of cultivated land. Although this seems larger than the average farm on the mainland of China, Formosan farm families average 6. 7 persons, as compared with 5. 4 persons on the mainland.

In 1939 more than 85 per cent of the farm families had less than the three hectares estimated necessary to maintain a comparatively reasonable standard of living (Table IV); and at present, because of the usurpations and annexations of the landlords, about 46 per cent operate farms of less than one hectare, of which 26 per cent are less than 0. 5 hectare. The poverty in rural districts and the hard life of farm families are plain. Those who operate farms of more than 10 hectares are less than 1 per cent of the total number of farm families."

"MULTIPLE CROPPING AND KINDS OF CROPS

The climate of Formosa is warm and hot the year round; rainfall is abundant, the growing season long. Therefore most of the cultivated lands have two harvests a year. In other words, the crop area is much greater than the cultivated area. From 1938 to 1942 the area of cultivated land averaged 858, 355 hectares, the crop area 1, 364, 561 hectares; the multiple-crop index was 159 per cent. Among the hsiens, Taichung has the highest multiple-crop index (176 per cent), Hwalien the lowest (142 per cent).

Of all kinds of cultivated land, the double-cropped paddy fields have the highest multiple-crop index. These fields, which produce at least two harvests a year, occupy about 38 per cent of the total cultivated area. In addition, other crops are planted between the seasons or between the rows of paddy, so that there may be five harvests in two years or three harvests in one year. The multiple-crop index of double-cropped paddy fields approximates the average crop index of the lower Yangtze Valley. In view of the total area of cultivated land, Formosa has the highest multiple-crop index of the provinces of China. It is a compensation for the small size of the farms.

Temperatures permit the growing of many kinds of crops in all seasons, but it is mainly the uneven distribution and amount of the rains that set the agricultural season.

In the southern part of the island rainfall is concentrated in the summer; the winter is extremely dry. In places without irrigation, only one crop of paddy rice can grow, and the time for seeding and planting is fixed. In the northern part, though there is no dry season, the low temperatures and frequent rain in winter are not suitable for paddy rice, and there is a longer time for intermediate crops and fallow. The typhoon season and the length of day are also factors controlling the farming rhythm.

According to the Taiwan Agricultural Yearbook, more than 70 kinds of crops are grown in Formosa. However, three -- paddy rice, sugar cane, and sweet potato-- make up 70 per cent of the total value of agricultural products and occupy 72 per cent of the total crop area (Table V).

The crops may be divided into three kinds: food, cash, and horticultural. Among the food crops, paddy rice is first, sweet potato second. The chief cash crops are sugar cane and tea; tobacco and groundnuts come next. The horticultural crops include fruits and vegetables: banana is the most abundant fruit, with pineapple and citrus fruits next; among the vegetables, radish and mustard leaf are grown the most.

There is no obvious regional distribution of the food crops. For example, the area percentages of rice and sweet potatoes do not vary much among [443] the hsiens. (In Penghu, on account of the frequent gales, rice cannot be grown, and consequently the percentages of sweet potato and groundnuts are unusually high.) The distribution of cash

and horticultural crops is comparatively centralized. For example, in Taipei and Hsinchu the crop area of tea gardens exceeds 10 per cent of the total crop area of each hsien (average, 1937-1939); in the other hsiens tea gardens are insignificant or lacking. The total crop area of banana plantations in Taichung and Kaohsiung is 85 per cent, and that of pineapple plantations 83 per cent, of the provincial total. The sugar-cane fields of Tainan and Taichung together occupy about 69 per cent of the crop area of sugar cane of the whole province; the citrus orchards of Taipei and Hsinchu occupy 68 per cent of the crop area of orchards of the whole province. As vegetables are mostly consumed locally, their distribution is similar to that of food crops. Largely because of the widespread cultivation of paddy rice, green manure is grown in all the hsiens except Penghu, but in Taipei the interval between the two paddy crops is too short to permit cultivation of green manure, and its crop-area percentage is therefore unusually low."

TABLE V—VALUE OF AGRICULTURAL PRODUCTS AND AREA OF THE CHIEF CROPS, 1936–1945*

CROP	VALUE (*in yen*)	% OF TOTAL VALUE	AREA (*in hectares*)	% OF TOTAL AREA
Paddy rice	272,153,000	47.09	620,560	46.31
Sugar cane	92,704,000	16.05	143,430	12.65
Sweet potato	40,260,000	6.90	142,768	12.59
Banana	12,932,000	2.23	18,003	1.59
Tea	11,581,000	2.00	42,004	3.70
Tobacco	7,082,000	1.22	3,330	0.29
Groundnuts	5,288,000	0.91	25,906	2.28
Pineapple	5,013,000	0.86	8,128	0.72
Radish	4,798,000	0.83	7,709	0.68
Citrus	4,583,000	0.79	4,881	0.43
Jute	2,606,000	0.45	11,167	0.98
Leaf mustard	2,044,000	0.35	3,178	0.28

* The total value of agricultural products includes the value of animal products, and the total crop hectare area includes green manure.

"ROTATION

Formosa enjoys the peculiar advantage of tropical and subtropical agriculture -- year-round rotation. The cycle of rotations for paddy fields ranges from one to four years, but one-year and two-year cycles are comparatively prevalent. The rotation cycle for dry fields is mostly limited to one or two years, except on sugar-cane plantations, where it runs into more than two years. [444]

The popular rotations and their cycles are as follows:

PADDY FIELDS

a) Paddy rice (Mar., Apr. -July)→Paddy rice (July, Aug. -Nov.)→Green manure (Dec. -Mar.)

b) Paddy rice (Mar., Apr. -July)→Sweet potatoes (Aug., Sept. -Jan. and Feb.)

c) Paddy rice (Mar., Apr. -July)→Paddy rice (July, Aug. -Nov.)→Vegetables (Dec. -Jan., Feb.)

d) Paddy rice (Mar., Apr. -July)→Paddy rice (July, Aug. -Nov.)→Overlapping sugar cane (1) (Oct. -Jan., Feb.)→Green manure (May-Nov.)→Sugar cane (Dec. -

1. 'Overlapping sugar cane' is so called because the young

sugar cane is planted between rows of the second crop of paddy rice when it is nearly ripe.

Mar., 3rd year)

DRY FIELDS

a) Groundnuts (May-Sept.) → Sweet potatoes (Oct.-Mar.)
b) Upland rice (Apr.-Aug.) → Sweet potatoes (Sept.-Mar.)
c) Green manure (May-Nov.) → Sugar cane (Dec.-Mar., 3rd year)

Paddy rice is generally the first crop. The growing season is usually four months; that for the second paddy crop, about three months and a half. Between the two growing seasons there is a so-called 'summer intermediate crop' season of one to two months; between the second season of one year and the first season of the following year there is a so-called 'winter intermediate crop' season of three to four months. The distribution of these seasons through the year varies according to the region. The first paddy crop is planted and harvested much earlier in the south than in the north. The second paddy crop is also planted and harvested much earlier in the south, but the difference in time is not so great. Thus the summer intermediate crop season begins earlier in the south

and lasts longer, but the winter intermediate crop season, though it begins earlier, does not last as long as in the north, because the following first paddy crop is planted much earlier.

The summer intermediate crop season, because of its short length and overabundant rainfall, is suitable only for green manure and two or three kinds of vegetables. On the other hand, the longer duration and better weather of the winter intermediate crop season make possible the cultivation of many kinds of crops. The duration of the winter intermediate crop season and the intensity of land utilization increase progressively northward; however, north of Hsinchu city the winter intermediate crops are usually delayed by the rainy and chilly weather. As a matter of fact, the middle part of the island, in spite of its rather dry winter, is the best area for winter intermediate crops, because of the development of irrigation; that is why Taichung has the highest multiple-crop index.[445]

Sugar cane is the second crop of Formosa. Since autumn planting became popular, the space left by the young sugar-cane crop has been utilized for sweet potatoes, groundnuts, cotton, wheat, and vegetables. In the paddy fields of the middle part sugar cane and paddy rice are alternately grown. Thus all the cultivated area of the island is utilized to the utmost."

8:Chen--445-454 N-3 (no date) 1951 Formosans--1-2
116, 241, 311

"INTENSITY OF LAND UTILIZATION

If compared with the agriculture of the Philippines and Siam, Formosan agriculture can be called 'intensive'; but in comparison with the agriculture of Japan, it is somewhat extensive. Moreover, rice is the staple crop of Formosa, and its chief production factors are manpower, fertilizer, animal labor, and implements.

To maintain the productivity of the land and increase crop yields, great quantities of fertilizer are needed. After the middle 1920's the use of fertilizer gradually increased—to 133 per cent of the 1924 amount in 1930, to 173 per cent in 1935, to 202 per cent in 1940, and to the peak of 410 per cent in 1943. From 1936 to 1945 the consumption of commercial fertilizer averaged 4, 293, 000 quintals a year, of which rice and sugar cane consumed the largest amounts (about 50 and 35 per cent respectively). But after the outbreak of the Second World War importation and use of fertilizer decreased, and consequently, fertilizer consumption and crop yield being closely related, the yield of rice and sugar cane also decreased.

Among the rice crops, the Ponlai rice, though its fertilizer and labor needs are greater than those of the native rice, is more commercial, and the method of cultivation is comparatively more progressive. But the intensity of Ponlai-rice cultivation is far

behind that of Japan, and only on the same level with that of Korea. For example, Formosa uses (1935) 34.6 per cent of the amount of natural fertilizer used in Japan, though it uses 119.3 per cent of commercial fertilizer; with respect to the cost per hectare, Formosa spends only 83 per cent as much as Japan. The number of manpower days per hectare is only 49.1 per cent of that in Japan, the amount of wages only 47.4 per cent. The number of animal-labor days per hectare is as much as 97.3 per cent of that in Japan, but the expenses for animal labor are only 57.1 per cent. The expenses for farm implements per hectare are only 28.7 per cent of Japan's. In short, the intensity of land utilization in Formosa is about 57.3 per cent of that in Japan and 95.4 per cent of that in Korea.

From 1931 to 1934 the cost of fertilizer used per hectare in Formosa averaged 51 yen a year; in Japan, 81 yen. However, Formosa's multiple-crop index is about 20 per cent higher than Japan's; consequently, the per [446-453 contain maps] [454] hectare cost of fertilizer must be reduced 20 per cent, to 40 yen—about half the cost in Japan. (Table VI).

The intensity of land utilization of a region is reflected in the unit-area production of the farmland. The intensity of land utilization in Formosa being lower than that in Japan, the average per hectare production of many crops is only 50 per cent of the Japanese production and approximates the average of the provinces of South China (Table VII)."

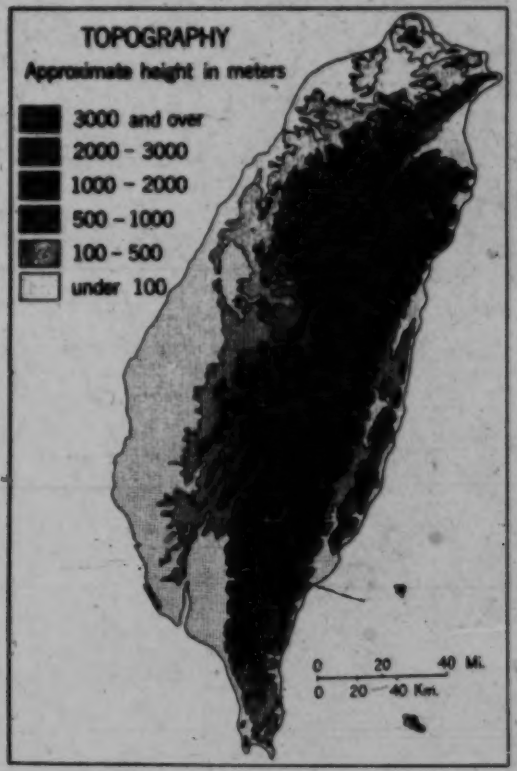
TOPOGRAPHY
Approximate height in meters
3000 and over
2000 - 3000
1000 - 2000
500 - 1000
100 - 500
under 100
0 20 40 Mi.
0 20 40 Km.

FIG. 2

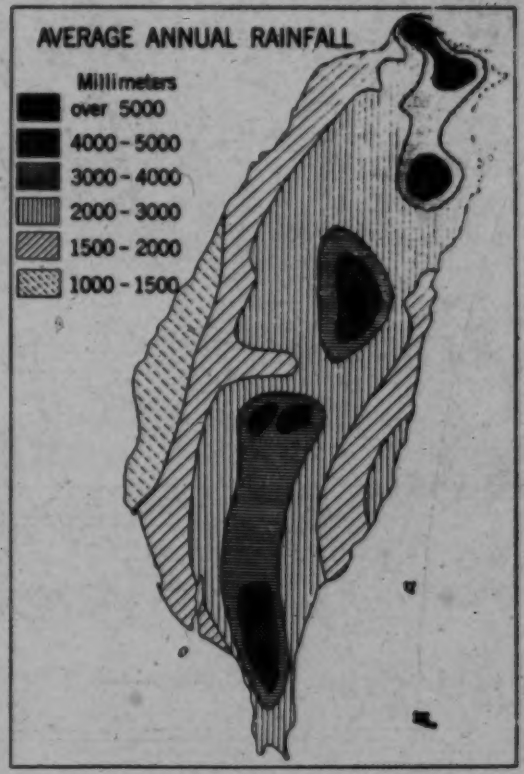
AVERAGE ANNUAL RAINFALL
Millimeters
over 5000
4000 - 5000
3000 - 4000
2000 - 3000
1500 - 2000
1000 - 1500

FIG. 3

8: Chen--447[2]
116, 241, 311

N-3 (no date) 1951 Formosans

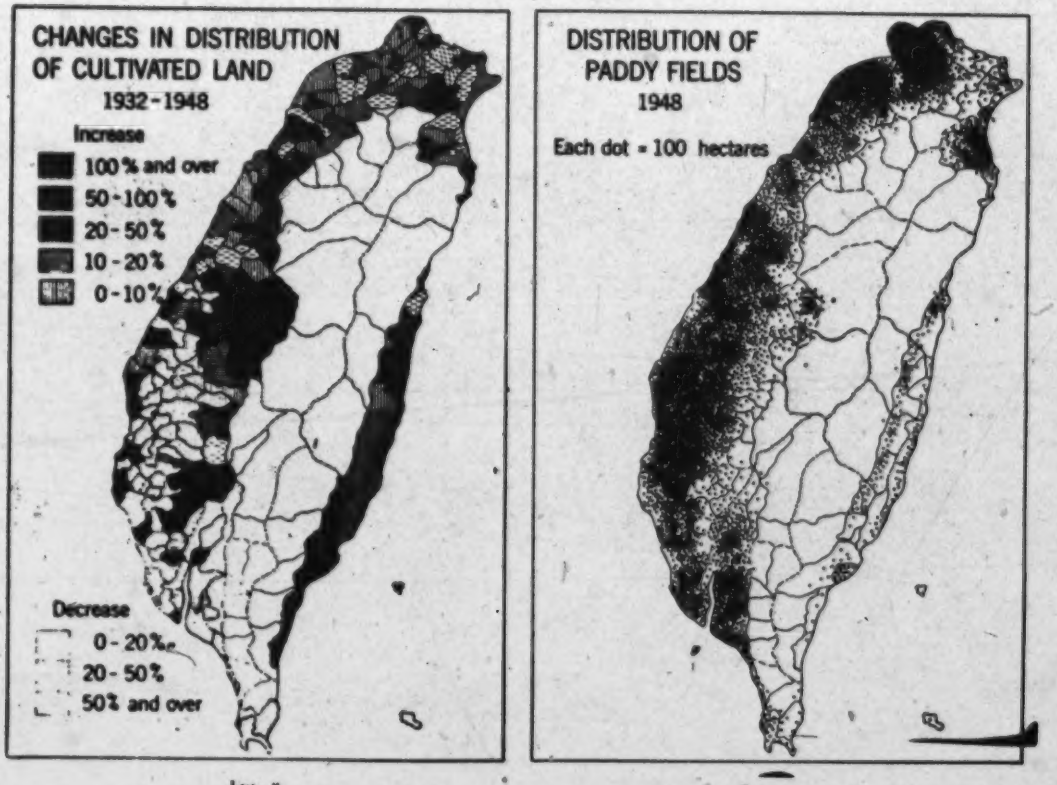

FIG. 8

8: Chen--448
116, 241, 311

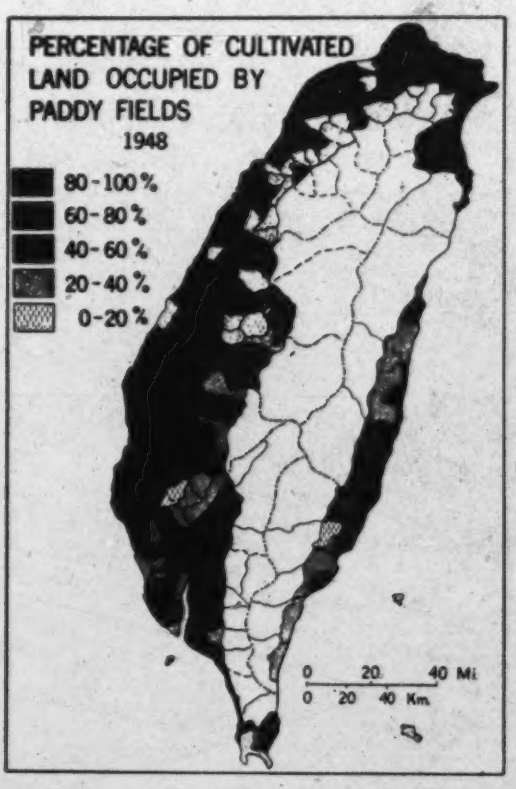

FIG. 10

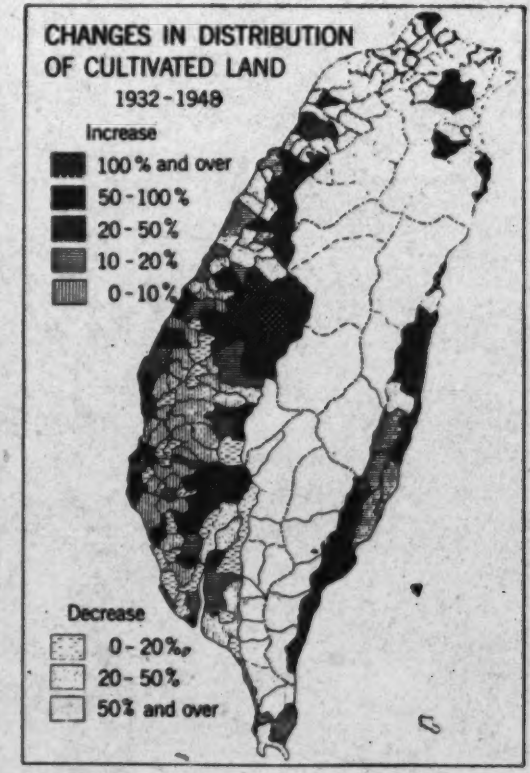

FIG. 11

8: Chen--448 [2]
116, 241, 311

N-3 (no date) 1951

Formosans

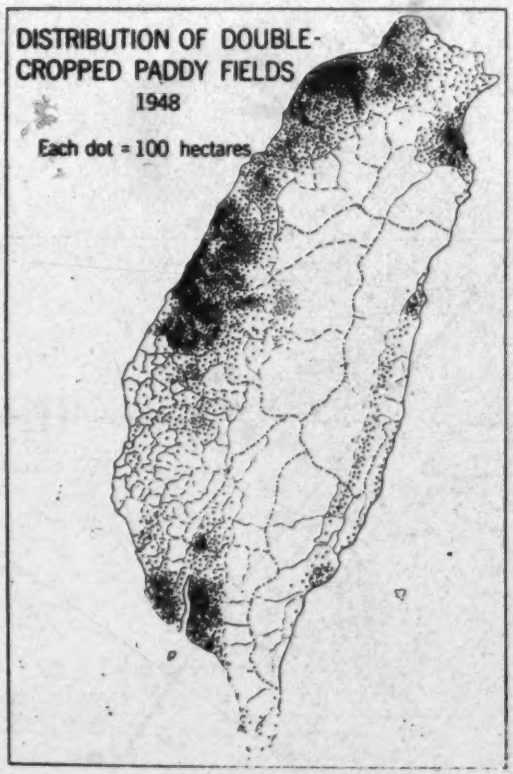

FIG. 12

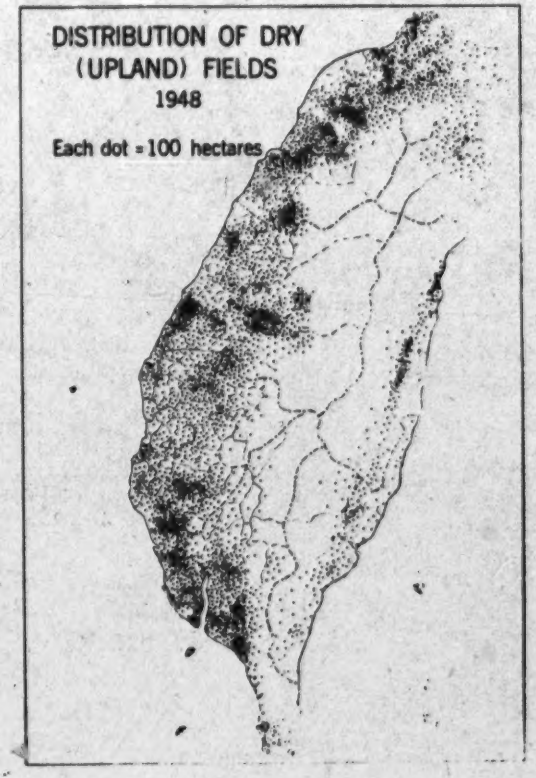

FIG. 11

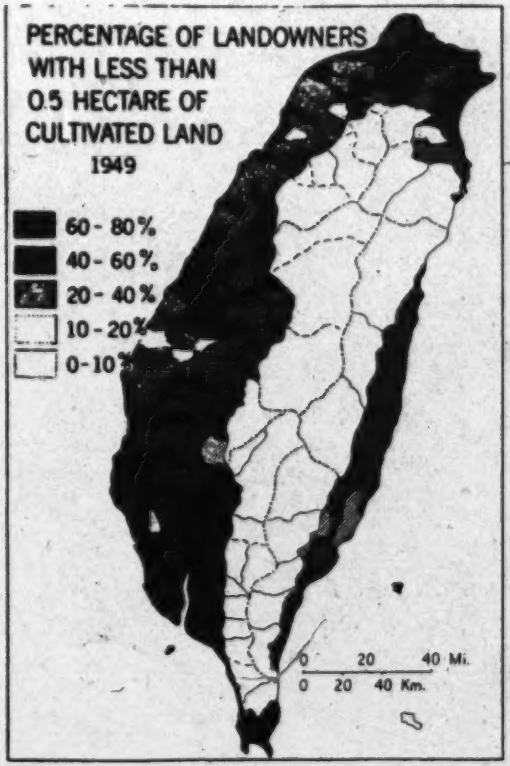
PERCENTAGE OF LANDOWNERS WITH LESS THAN 0.5 HECTARE OF CULTIVATED LAND
1949
60 - 80%
40 - 60%
20 - 40%
10 - 20%
0-10%
0 20 40 Mi.
0 20 40 Km.

FIG. 14

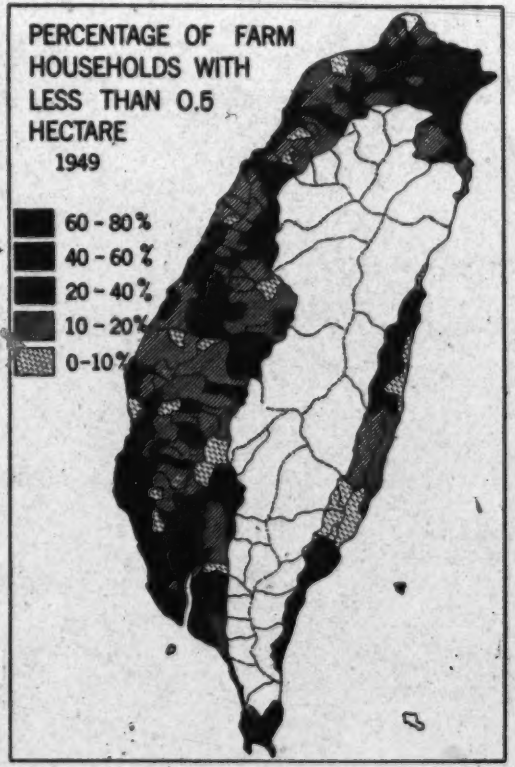
PERCENTAGE OF FARM HOUSEHOLDS WITH LESS THAN 0.5 HECTARE
1949
60 - 80%
40 - 60%
20 - 40%
10 - 20%
0-10%

FIG. 15

8: Chen--449 [2] N-3 (no date) 1951 Formosans
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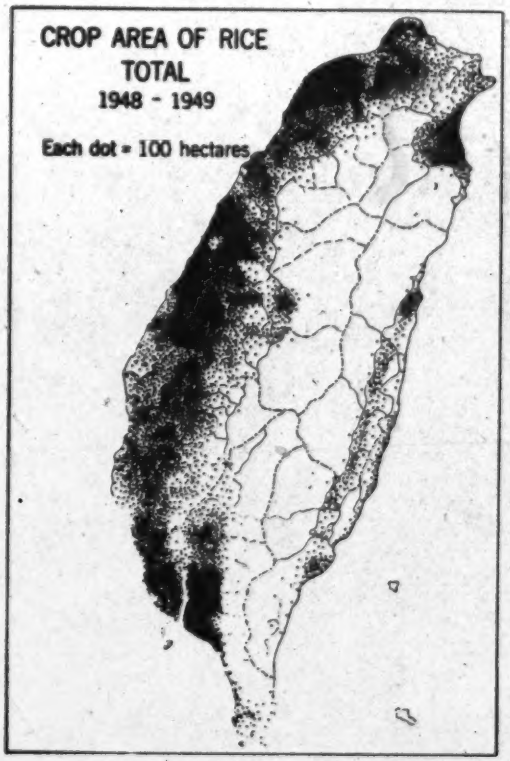

FIG. 16

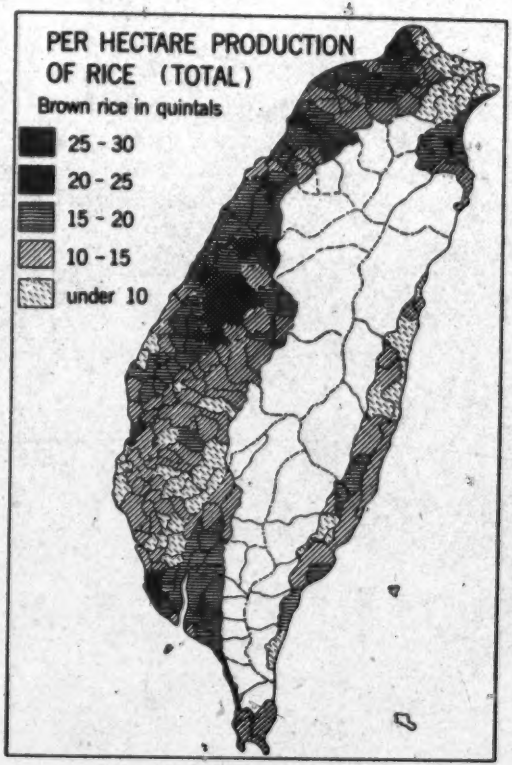

FIG. 17

8: Chen--450
116, 243, 311

N-3 (no date) 1951 Formosans

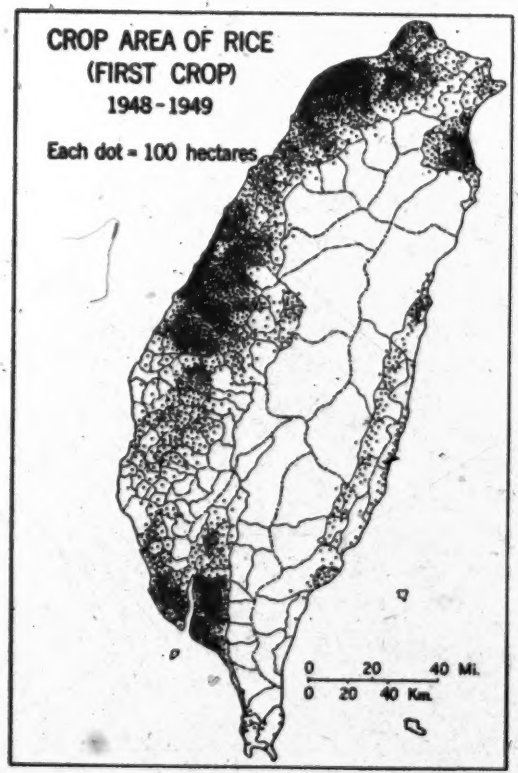

FIG. 18

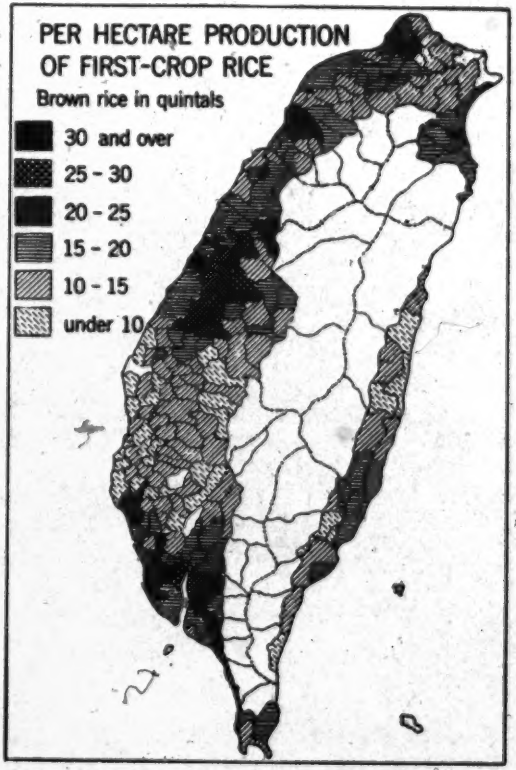

FIG. 19

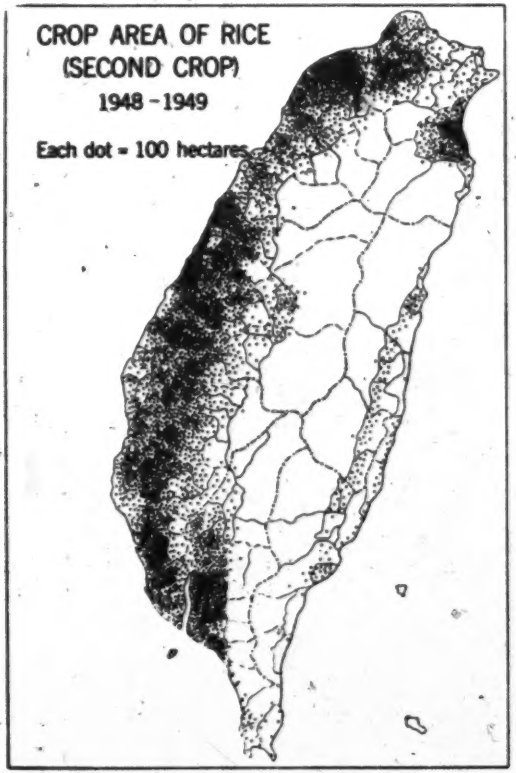
CROP AREA OF RICE
(SECOND CROP)
1948 - 1949
Each dot = 100 hectares

FIG. 20

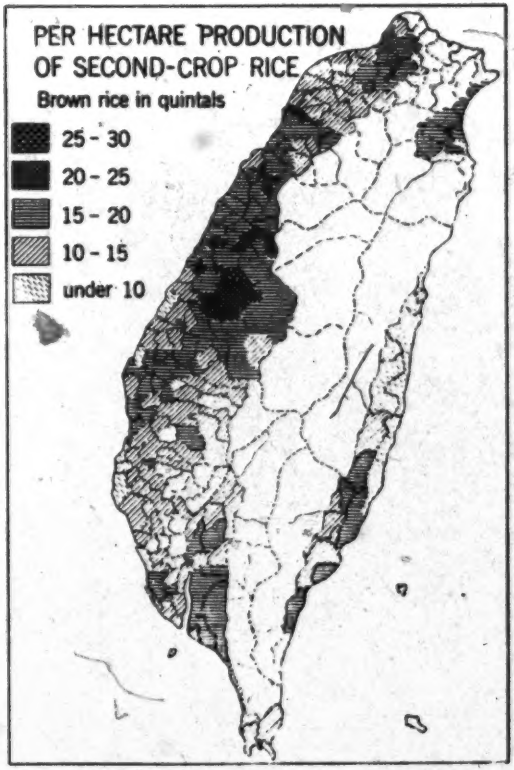
PER HECTARE PRODUCTION
OF SECOND-CROP RICE
Brown rice in quintals
25 - 30
20 - 25
15 - 20
10 - 15
under 10

FIG. 21

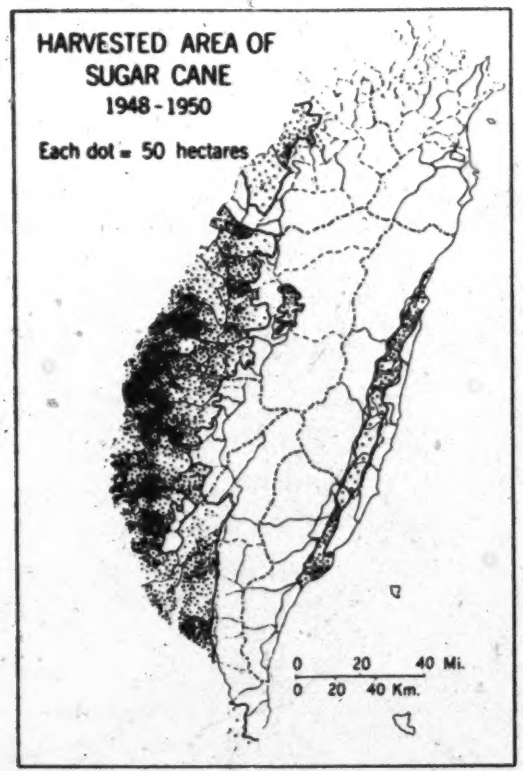
HARVESTED AREA OF
SUGAR CANE
1948-1950
Each dot = 50 hectares
0 20 40 Mi.
0 20 40 Km.

FIG. 22

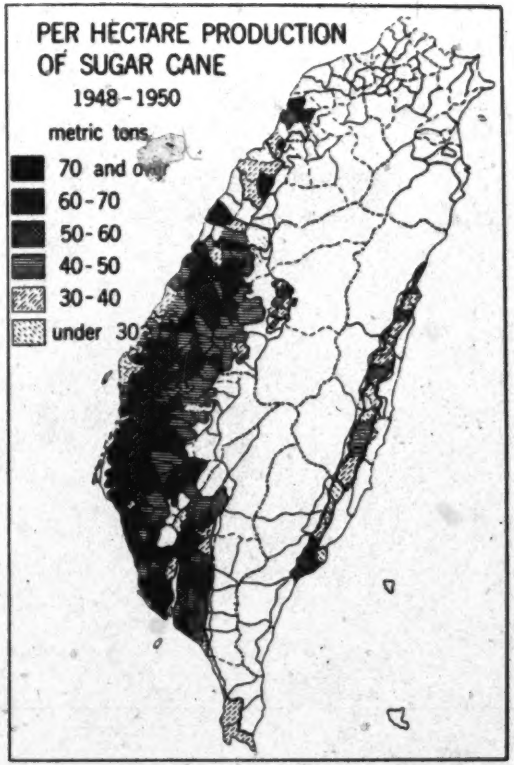
PER HECTARE PRODUCTION
OF SUGAR CANE
1948-1950
metric tons
70 and over
60-70
50-60
40-50
30-40
under 30

FIG. 23

8: Chen--446 [2]
116, 175, 312

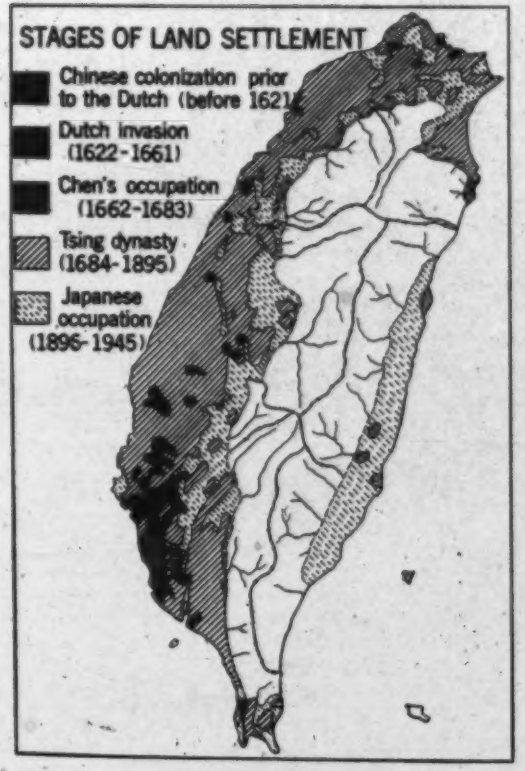
STAGES OF LAND SETTLEMENT
Chinese colonization prior to the Dutch (before 1621)
Dutch invasion (1622-1661)
Chen's occupation (1662-1683)
Tsing dynasty (1684-1895)
Japanese occupation (1896-1945)

FIG. 4

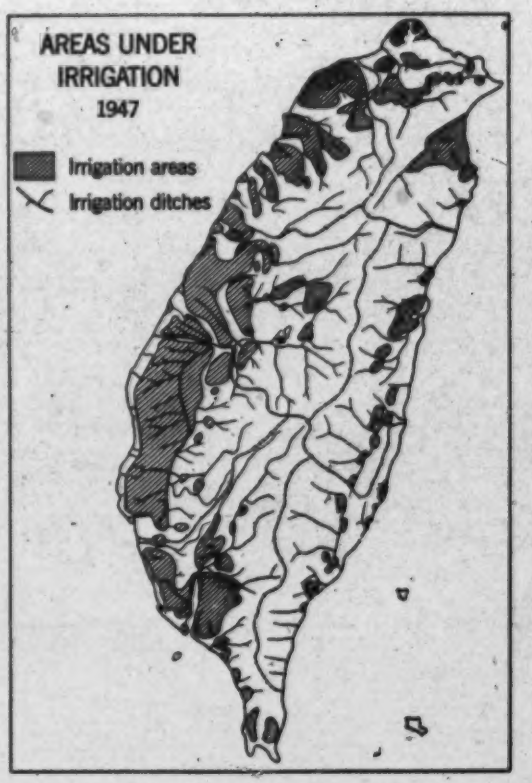

FIG. 5

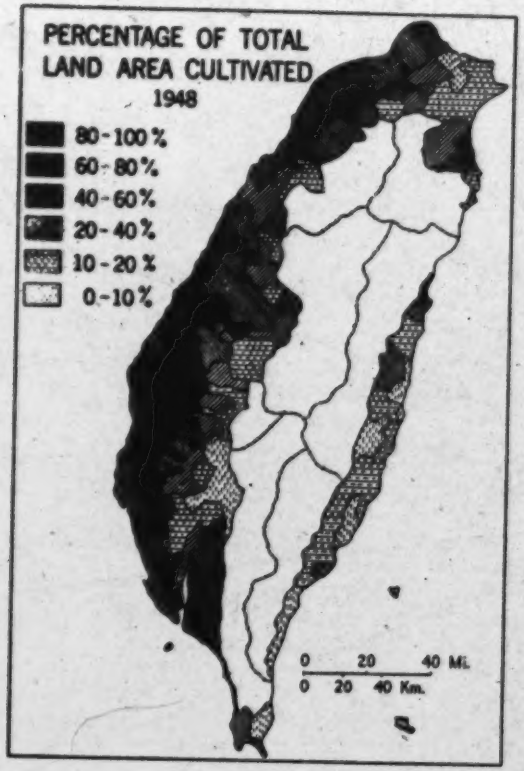
PERCENTAGE OF TOTAL
LAND AREA CULTIVATED
1948
80-100%
60-80%
40-60%
20-40%
10-20%
0-10%
0 20 40 Mi.
0 20 40 Km.

Fig. 6

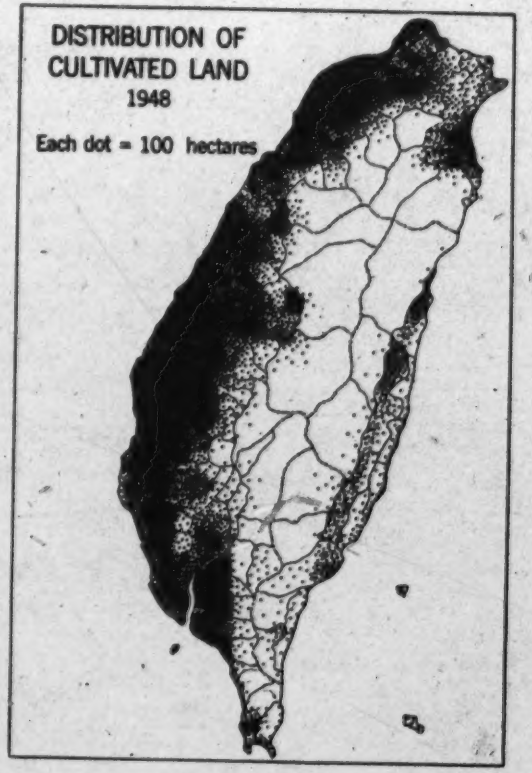
DISTRIBUTION OF
CULTIVATED LAND
1948
Each dot = 100 hectares

Fig. 7

DISTRIBUTION OF
TEA GARDENS
1936-1940
Each dot = 10 hectares

FIG. 24

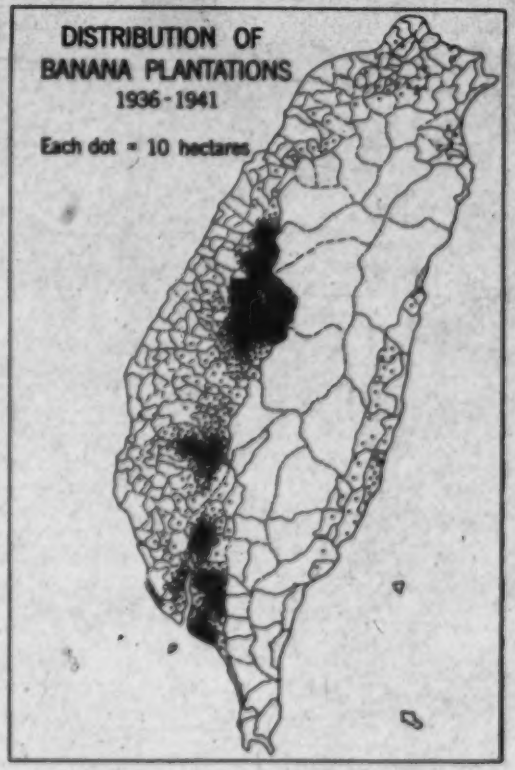
DISTRIBUTION OF
BANANA PLANTATIONS
1936-1941
Each dot = 10 hectares

FIG. 25

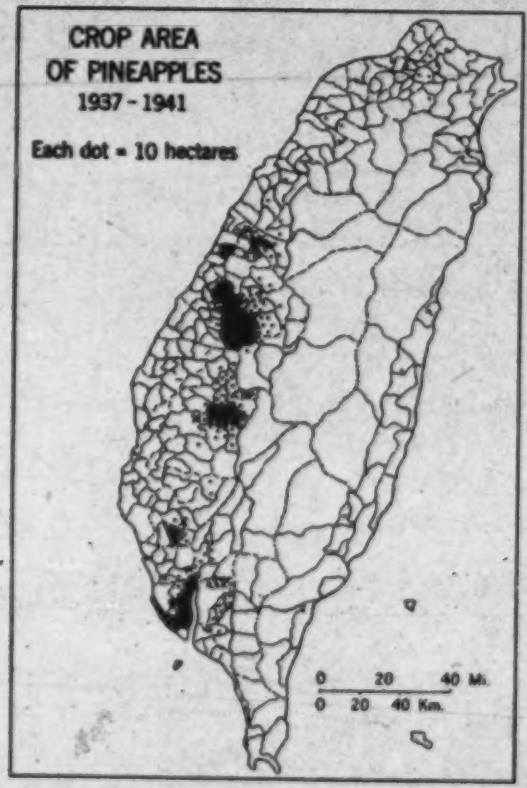
CROP AREA
OF PINEAPPLES
1937 - 1941
Each dot = 10 hectares
0 20 40 Mi.
0 20 40 Km.

Fig. 26

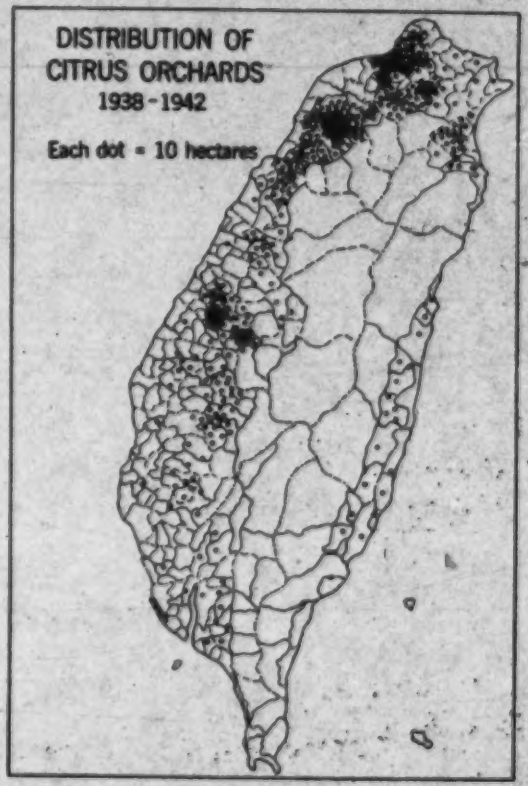
DISTRIBUTION OF
CITRUS ORCHARDS
1938 - 1942
Each dot = 10 hectares

Fig. 27

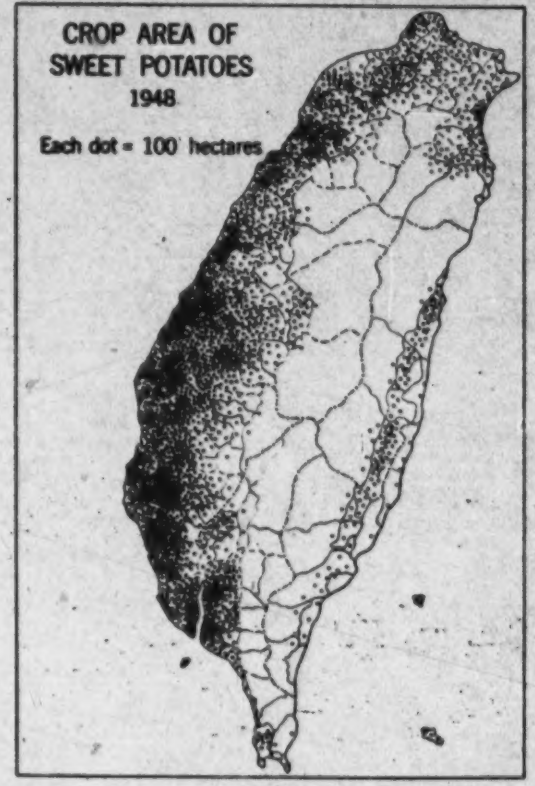
CROP AREA OF
SWEET POTATOES
1948
Each dot = 100 hectares

FIG. 28

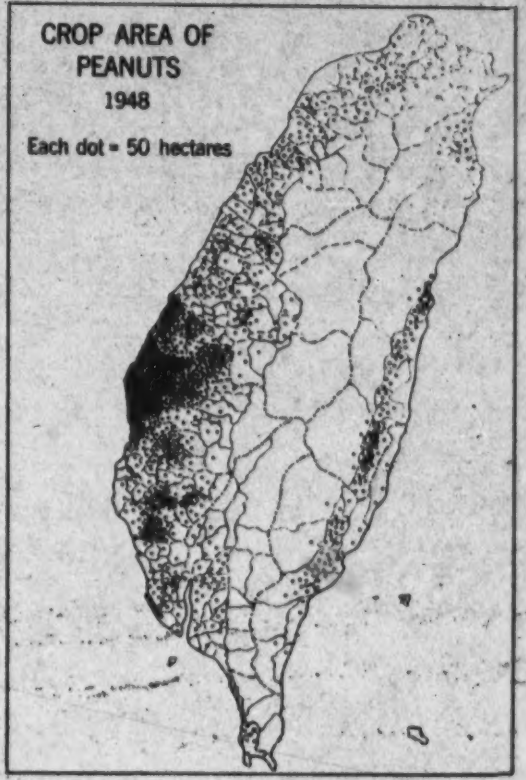
CROP AREA OF
PEANUTS
1948
Each dot = 50 hectares

FIG. 29

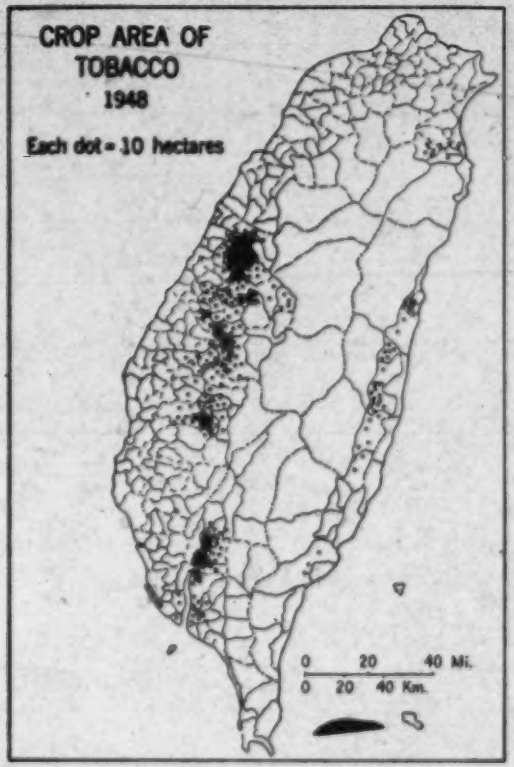
CROP AREA OF
TOBACCO
1948
Each dot = 10 hectares
0 20 40 Mi.
0 20 40 Km.

FIG. 30

CROP AREA OF JUTE
1948
Each dot = 10 hectares

FIG. 31

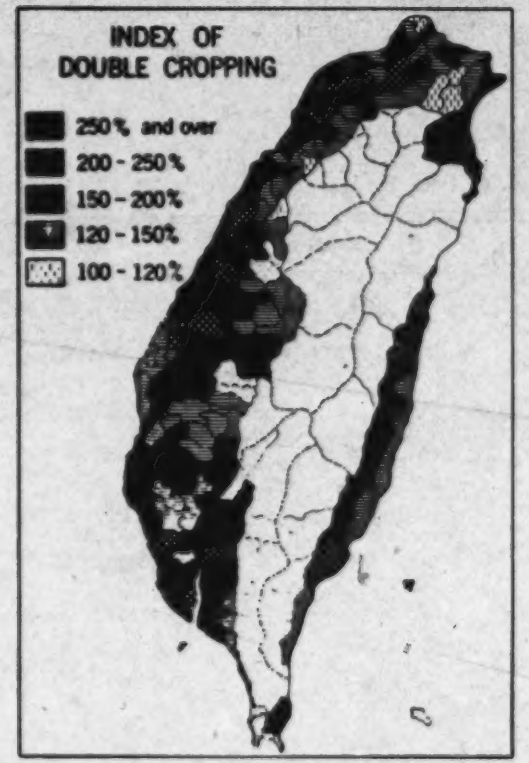
INDEX OF
DOUBLE CROPPING
250% and over
200 - 250%
150 - 200%
120 - 150%
100 - 120%

Fig. 32

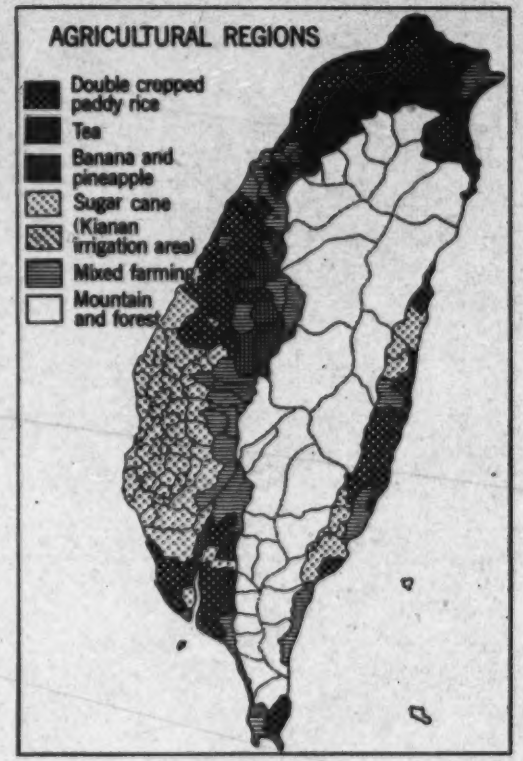
AGRICULTURAL REGIONS
Double cropped paddy rice
Tea
Banana and pineapple
Sugar cane
(Kianan irrigation area)
Mixed farming
Mountain and forest

Fig. 33

3: Chen--454
116, 241

TABLE VI—PER HECTARE COST OF FERTILIZER IN FORMOSA AND JAPAN
(*In yen*)

	1931	1932	1933	1934	AVERAGE
Formosa					
Commercial	21	25	33	41	30
Natural	20	21	21	23	21
Total	41	46	54	64	51
Japan					
Commercial	31	33	37	38	35
Natural	42	43	49	50	46
Total	73	76	86	88	81

TABLE VII—YIELD PER HECTARE, FORMOSA AND JAPAN, 1938–1940
(*In quintals*)

CROP	FORMOSA	JAPAN	FORM./JAP.	CROP	FORMOSA	JAPAN	FORM./JAP.
			%				%
Sugar cane[a]	692.22	558.96	123.84	Wheat	11.04	20.99	52.60
Sweet potato	114.55	129.64	88.36	Radish	95.22	231.00	41.22
Sweet corn	12.94	16.05	80.62	Upland rice	10.45	26.03	40.15
Paddy rice	19.91	29.17	68.26	Jute	12.43	31.44	39.54
Soybean	6.36	10.64	59.77	Barley[b]	5.61	22.64	24.78

[a] Because of the incompleteness of the Japanese statistics of 1940, the yield of sugar cane is the average of the three years 1937–1939.

[b] In 1939 and 1940 the average per hectare yield of barley in Japan was extremely high, that in Formosa extremely low. From 1936 to 1938 the average yield in Formosa was 7.92 quintals, 37.77 per cent of the Japanese yield of 20.97 quintals.

8: Chen--454[2]
116, 132, 241, 312

N-3 (no date) 1951 Formosans

"IRRIGATION

The general increase in per hectare production in Formosa in recent years is largely due to the progress of irrigation and additional fertilization, as well as to improvement of cultivation and seeding. Because of the great variation in rainfall and the location of the main agricultural region on the western coastal plan, where the winter is extremely dry and the dry season is long, irrigation is necessary. On the other hand, in summer, especially when typhoons pass over the island, the precipitous topography results in floods. The northeast corner, facing the northeast winter monsoon, has plenty of rain the year round; in fact, in many places the winter rainfall is greater than that of summer, and floods are not infrequent. Consequently, drainage and flood control are as important as irrigation."

8: Chen--455
116, 241 312

TABLE VIII—AREA UNDER IRRIGATION AND DRAINAGE IN FORMOSA
(*In hectares*)

YEAR	CULTIVATED AREA	IRRIGATION AND DRAINAGE	%
1903	534,157	150,456	28.2
1910	674,100	226,706	33.6
1920	749,419	305,270	40.7
1930	812,116	441,477	54.4
1940	860,439	530,113	61.6
1948	863,156	505,933	58.6

TABLE IX—CULTIVATED LAND UNDER IRRIGATION AND DRAINAGE, BY HSIENS
(*In hectares*)

HSIEN	1940 AREA	1940 %	1948 AREA	1948 %
Taipei	43,801	46.77	47,728	52.80
Hsinchu	89,077	60.02	56,269	37.37
Taichung	120,323	69.93	102,654	58.49
Tainan	178,612	66.70	222,160	85.10
Kaohsiung	77,194	60.62	61,500	46.60
Taitung	7,508	43.21	5,907	28.53
Hwalien	13,598	50.73	9,715	37.98

8: Chen--455-456 N-3 (no date) 1951 Formosans--1-2
116, 241, 312, 177.31 Japan
636.31

"To a certain extent, irrigation in Formosa was well developed long before the Japanese occupation. As recorded in the twenty-seventh volume of the 'General History of Taiwan' in the later years of the Tsing dynasty, the total number of irrigation reservoirs and ditches was 234. After the occupation the Japanese paid considerable attention to irrigation and drainage. In 1901 'Regulations Governing Public Irrigation Systems' were promulgated, and since then the area under irrigation and drainage has increased annually (Table VIII). In 1903 the total area under irrigation and drainage was 150,456 hectares, 28 per cent of the total cultivated area; in 1942 it had increased to 545,094 hectares, about 64 per cent of the total cultivated area. In area under irrigation and drainage Tainan is first among the hsiens (1948); Taichung comes next; then follow Hsinchu, Kaohsiung, Taipei, Hwalien, and Taitung; Penghu has no irrigation (Table IX). In percentage of cultivated land under irrigation and drainage Tainan is again highest, Taitung lowest.

Among irrigation works in Formosa, the Kianan system, in western Tainan, is the most famous. Construction was begun in 1920 and was finished in 1930, at a total cost of 54,013,000 yen. Today 140,000 hectares of cultivated land are irrigated from the Chenven and Chuhsiu Rivers. Since completion of the Kianan system, land price and land rent within its irrigating area have greatly increased. In 1920 the average land price was

313 yen per hectare, in 1935 it was 1144 yen; land rent rose from an average of [456] 36 yen per hectare to 128 yen; and the value of the yield per hectare increased from an average of 90 yen to 361 yen.

Before the Kianan irrigation system was completed, the average per hectare yield of the rice grown in the western part of Tainan was only 19 quintals. After its completion, because there were still limitations on water supply, paddy rice was grown with sugar cane and sweet potato in a three-year rotation; the yield increased to 27 quintals per hectare. The annual profit on paddy rice, when grown alone, had been 194 yen, totaling 582 yen in three years, but the profit on the rotation was 524 yen for the first year, 272 yen for the second year, and 454 yen for the third, totaling 1250 yen — more than twice the original three years' profit."